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Brain Physiology, Egoistic and Empathic Motivation, and Brain Plasticity: Toward a More Human Economics

Abstract

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The brain physiology research of leading evolutionary neuroscientist, Paul MacLean, has important implications for human economic motivation. Gerald Cory in his research has admirably utilized MacLean's findings and has persuasively explained that humans have two dominant motivations: 1) ego or self-interest and 2) empathy or other-interest, which our brains attempt to balance. This view is clearly important and at odds with mainstream economics in which self-interest is the dominant motivation. The MacLean-Cory view, also known as Dual Motive Theory (DMT), represents a serious challenge to mainstream economics and has begun to attract considerable interest. However, the DMT leaves something to be desired. While understanding the promise of the perspective deriving from brain physiology, some scholars have expressed dissatisfaction with how the three level modular brain model has been used to explain economic behavior. Accordingly, the purpose of this paper is to integrate DMT with the concept of brain plasticity.

Brain plasticity refers to the ability of the brain to change structurally and functionally as a result of input from the environment. Some of this plasticity is no doubt genetically determined but some brain change is a product of individual effort and represents the individual's investment in intangible capital (standard human capital, social capital, personal capital, and so on). In this revised view, the balance that individuals, groups, and societies strike between ego and empathy orientation is to a great extent determined by these intangible investments, not simply by brain physiology. In other words, it is the plastic aspect of the brain that determines how the capacity associated with brain physiology gets expressed.

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Introduction

The brain physiology research of leading evolutionary neuroscientist, Paul MacLean, has important implications for human economic motivation. Gerald Cory in his research has admirably utilized MacLean's findings and has persuasively explained that humans have two dominant motivations: 1) ego or self-interest and 2) empathy or other-interest, which our brains attempt to balance. This view is clearly important and at odds with mainstream economics in which self-interest is the dominant motivation. In the view of mainstream economists, all other motivations such as empathy are subordinate to self-interest. The MacLean-Cory view, also known as Dual Motive Theory (DMT), represents a serious challenge to mainstream economics and has begun to attract considerable interest. However, the DMT which traverses the terrain between brain physiology and concrete economic behavior leaves something to be desired. While understanding the promise of the perspective deriving from brain physiology, some students and experienced scholars have expressed dissatisfaction with how the three level modular brain perspective has been used to explain specific, concrete economic behavior. Accordingly, the purpose of this paper is to revise the MacLean-Cory conceptual framework and draw out its implications for economic behavior.

An important aspect of this revision is its focus on a variety of brain capacities. It is useful to think of the three level (triune) brain conception as representing a fundamental human capacity, i.e., the capacity for acting in accord with self-interest, with

other interest, or some balance of the two motives. The basic capacity associated with brain physiology is referred to here as the "hard" brain, which all humans have regardless of age, education, or experience. There is, however, reason to believe that an individual's brain capacity is also determined by one's "soft" brain, the part of the brain that does not develop the same way in every human. The soft part develops differently depending on the experiences of and influences on the individual. Stating that there is a soft or changeable part of the brain is essentially the same as stating that there is brain plasticity. Some of this changeability or plasticity is no doubt genetically determined but some brain change is a product of individual effort and represents the individual's investment in intangible capital (standard human capital, social capital, personal capital, and so on) (Tomer 2008). Accordingly, the balance that individuals, groups, and societies strike between ego and empathy orientation is to a great extent determined by these intangible investments, not simply by the brain physiology common to all. In other words, it is the soft or plastic aspect of the brain that determines how the capacity of the hard brain gets expressed. Different individuals and societies are very different in this regard.

The broad concept of human development corresponds to a great extent to growth of the soft brain, and this process involves growth in a variety of human mental capacities including empathy. The human development process may also raise the individual's and society's capacity for striking a desirable balance between ego and empathy. Thus, there is reason to believe that intangible investments resulting in soft brain change are a key to how the capacity of the hard brain becomes manifest. An important part of the process of attempting to improve dual motive theory is developing the distinction between the hard and soft parts of the brain and understanding how brain capacities change.

The Importance of Brain Physiology a la MacLean

Paul MacLean's research on brain physiology is extremely important beause of the perspective it provides on human motivation. At the heart of MacLean's research is his conception of the human brain as having three interconnected modular levels. It is in a sense three brains in one, a triune brain, which reflects to a considerable degree the evolutionary path from reptiles to early mammals to late mammals (MacLean 1990, pp. 8-9). These three brains are like biological computers operating somewhat independently but of necessity meshing with and functioning with each other (see Ploog 2003, p. 489).

The first or earliest of these brains, in evolutionary terms, the innermost core of the brain, is the reptilian complex which 1) governs fundamental physiological operations such as blood circulation, heartbeat, respiration, food-getting, reproduction, and defensive behavior, 2) governs the regulation of an animal's or human's daily master routine and subroutines, and 3) is concerned with self preservation or self-interest (MacLean 1990, pp. 15-16; Cory 2006, p. 25).

The second brain, the paleomammalian complex, sometimes identified as the limbic system, is located largely on top of the reptilian brain. This brain provides for distinctively mammalian features (not found in reptiles) such as warmbloodedness, maternal care, parental responsibility, nursing, infant attachment, audiovocal communication between mother and child, play, and more generally family life and social bonding. It is also associated with emotional behavior and procreation (MacLean 1990, 17; Cory 2006, 26). In contrast to the self-interest orientation of the reptilian brain, it is oriented to caring, other interest, and empathy.

The third brain, the neomammalian complex or neocortex, is the large mass of hemispherical brain matter which envelopes the other two brains. This brain provides the capacity for problem solving, learning, memory of details, language, communication of thoughts and feelings, and the creation and preservation of ideas (MacLean 1990, p. 17; Cory 2006, p. 26). This brain allows humans to make behavioral adaptations to complex circumstances.

This human brain structure and circuitry evolved over millions of years. The three evolved brain modules or neural assemblies constitute a hierarchy in which the whole is greater than the sum of its parts (MacLean 1990, pp. 8-9; see also Wilson 2006, pp. 628-629). It is important to note that MacLean's contribution is integrative in nature, not reductive. As such he provides an overall evolutionary phylogenetic perspective on brain functioning that may not coincide precisely with findings of scientists operating in reductive and comparative structural functional modes. This is to be expected and does not invalidate his invaluable contribution. Even if it does not link exactly with evolutionary history, MacLean's conception of "the triune brain can be seen as a powerful organizing theme that is grounded in the three largely distinct evolutionary layers of the human brain" (*Wikipedia*, "Triune brain", August 12, 2010)

The Conflict Systems Neurobehavioral Model a la Cory

The conflict systems neurobehavioral (CSN) model developed by Gerald Cory (1999) is based on MacLean's conception of brain physiology, and it elucidates the dynamic balancing behavior of the neomammalian complex. According to Cory, the two core motivations, 1) ego or self-interest deriving from the reptilian brain and 2) empathy or other-interest deriving from the paleomammalian brain, may at times be out of

balance. Due to this, it is up to the executive programming provided by the neocortex or neomammalian brain to attempt to bring about a balance between the two motivations (Cory 2006, pp. 26-27). When one or both of the two fundamental motivations cannot find satisfactory expression due to some unresolved conflict or blockage, behavioral tension and stress are produced in the individual. In response to this tension and stress, the executive program of the individual's neocortex will be enlisted to deal with the difficulty, thereby helping the person make a moral and rational choice, which should restore a sense of balance and reduce the tension (pp. 27-28).

If the balancing is relatively successful, the outcome will be in the dynamic balance range which is associated with compromise, fairness, justice, and respect for self and others, a relative equality of ego and empathy (Cory 2006, pp. 28-29). Alternatively, the outcome might wind up in the egoistic range or the empathetic range, relatively unbalanced outcomes. The egoistic range is associated with power seeking, domination, assertiveness, competitiveness, and self over others. The empathetic range is associated with self-sacrifice, submission, responsiveness, supportiveness, and others over self.

Highly egoistic behavior involves neglected empathy and may be experienced as a sense of obligation to others. Whereas others to whom the egoistic behavior is directed may experience a sense of imposition, hurt, and desire to "even the score". Conversely, highly empathetic behavior may be experienced as neglected self-interest, a need to "collect our due", resentment, and victimization. Both the above involve substantial tension. On the other hand, dynamic balanced behavior creates feelings of mutuality, shared respect, and a relative absence of tension. This dynamic balance is the central tendency and is associated with reciprocity, a universal norm of behavior. The CSN

model tends to produce this balance, and thus cooperation, fairness, and morality, all outcomes facilitating desirable market and other economic behavior.

It should be emphasized that the CSN model is a descriptive model, not a normative model. On the one hand, the dynamic balance outcome tends to be produced by the homeostatic process involved, and it is a better outcome than those in the two unbalanced ranges. On the other hand, the balanced outcome should not be idealized. While it may be a good enough outcome to facilitate trade and other economic activity, it certainly does not imply that the behavior of the people involved is highly moral, saintly or "enlightened".[1] Nevertheless, the tendency to achieve dynamic balance does indicate that humans are strongly motivated by both ego and empathy and that they have a strong tendency to achieve a balance between ego and empathy that is favorable for economic activity.

Modeling the Human Brain in Economics

The above summary of Dual Motive Theory (DMT), which is MacLean's brain physiology combined with Cory's CSN model, implies a fundamentally different model of the human brain than the one implied by mainstream economic (ME) theory. Below the essential feature of these two models are compared.

The Pure Mainstream Economic Model

Based on the typical assumptions of ME theory, the implied model of the human brain can be discerned. This model features the following:

1) People's one dominant or sole motivation is self-interest

    a. All other emotions or considerations are subordinate to self-interest

b. People may seem to act in the interests of others but only if it is in their self-interest to do so.

2) People have infinite (or very high) cognitive capacity.

3) People have zero capacity for pure empathetic motivation.

4) Rationality involves applying logic or reason to choose or obtain the best possible outcome(s) (generally satisfaction of wants) for oneself regardless of the nature of the wants.

5) In the pure version of the ME model, no human capacity differences exist. Everyone has an infinite cognitive capacity and zero empathetic capacity. In revised, not so pure, versions of ME, people's investment in various types of human capital, especially standard human capital, may change some of their human capacities.

The DMT Model of the Human Brain

The DMT model of the human brain includes features which contrast sharply from the ME model. These features include:

1) People have two dominant motivations.

a. Ego or self-interest

b. Empathy or other-interest

2) The model seems to imply that people have limited, but adequate, cognitive capacity for most purposes (similar to but not the same as bounded rationality).

3) People have a strong capacity to achieve a balance between the two dominant motivations.

a. Imbalances tend to be corrected with the rise of tension or stress which directs people's attention to the imbalance.

b. Some imbalances are persisting and not easily corrected (they involve pathologies, either individual or societal).

4) Rationality has a different meaning than it does in the ME model. Rationality in the DMT model involves a) striving for a balance between self- and other-interest as well as b) application of logic and reason to attain the person's goals or desires.

Rationality here is not a matter of simply maximizing the self's utility or satisfaction. It involves doing well for self and doing well by others, i.e., living a successful well-balanced life. This rationality is necessarily a matter of both ends and means. Behavior is not rational unless the person is attempting to help others (ends) as well as making choices (means) conducive to one's own satisfaction.

5) Strictly speaking, the DMT model is silent on human mental capacities. The model, however, does imply that people have mental capacities such as the following:

a. Empathetic capacity

b. Cognitive capacity

c. Integrative capacity, capacity for achieving a desirable balance between ego and empathy

d. Achievement capacity, capacity for pursuing and attaining goals

6) The DMT model emphasizes the particular human capacities that arise from the structure of the brain or brain physiology. The essentials of brain physiology are

the same for all humans, i.e., they are determined by human genetic makeup. In this model, differences among individuals in brain capacity would be due to individual genetic differences and differences in how these capacities change over different life stages (also determined genetically). The DMT model is silent on difference in capacity among individuals on account of differences in investment in human capital. This aspect, however, could be added to the model.[2]

Comparing the Two Human Brain Models

Arguably, due to its fundamental assumptions, the ME model depicts 1) humans' cognitive capacities as unrealistically high and 2) a number of other human intangible capacities (empathetic, integrative, achievement, and perhaps others) as unrealistically low or nonexistent. With the perspective afforded by the knowledge of brain physiology from MacLean, Cory, and others, the ME model's depiction of human behavior would seem to be very biased and unbalanced (see Rosenau 2006). For certain types of economic analysis, the ME model's bias might not matter much. But for other types of analysis where human motivation and intangible capacities are critical, the ME model's biases are likely to prevent us from achieving a satisfactory level of understanding. For the latter types of analysis, the DMT model is clearly advantageous.

Going Beyond the Basic Dual Motive Theory

Paul MacLean and Gerald Cory have paved the way, but if DMT and knowledge of brain science are to be incorporated into economics, a great deal of work remains to be done. The rest of this paper is intended to make a start on this. Part of the task involves marshalling relevant knowledge about brain science and empathy. The other part of the task involves sketching a framework useful for explaining how this knowledge can be

useful, i.e., useful for providing a model which is based on the core features of DMT but which adds new features to make the model more human and more helpful in gaining a better understanding of important economic endeavors.

Findings of Brain Science: Brain Plasticity

The first important insight from brain science goes under the heading of brain plasticity (or neuroplasticity). Brain plasticity refers to the ability of the brain to change structurally and functionally as a result of input from the environment (*Wikipedia*, "Neuroplasticity," October 11, 2011). This input could take many forms including external stimuli which lead to learning or events causing brain damage. It is widely recognized that there is a critical period in early childhood when the brain is extremely plastic. However, after the critical period, the consensus of neuroscientists has been that brain structure is relatively immutable. Recent findings challenge this conventional wisdom and suggest that many aspects of the brain continue to be plastic throughout one's life. So even though every human has basically the same brain physiology, and every human has particular genetically based brain capacities, a person's brain functioning is shaped as well by the individual's unique path through life.

The conventional wisdom of an unchanging brain anatomy after childhood is associated with the notion of localization. According to localization, the brain is like a machine made of many parts, "each performs a single function, so that if one of those parts was damaged, nothing could be done to replace it" (Doidge 2007, p. 13; see also Begley 2007, pp. 31-32). Localization implies, for example, that each of our six senses are processed in a different part of the brain and can only be processed in that part of the brain. Similarly, localization implies fixed specialization of the brain hemispheres

(Doidge 2007, p. 278). "One function, one location" expresses this hardwiring of the brain (p. 17). It is important to note that the view of an unchanging brain anatomy implies that human nature is relatively fixed (p. xviii).

Much of the findings from recent research supports brain plasticity and rejects localization. There are three main types of brain plasticity. First is the brain change that occurs as the physical and chemical environment of individual neurons changes in response to external and/or internal events. These changes result in changes in neuronal connections or wiring, changing their strength and their current circuit patterns. Second is the anatomical brain change that occurs allowing a particular function to be perfomed by a different structure or set of brain modules (Doidge 2007, pp. 276, 295). Third is neurogenesis, the birth of new neurons (Begley 2007, pp. 52-72).

The following insights are related to brain plasticity. First, "culture is not just produced by the brain; it is also by definition a series of activities that shape the mind" (Doidge 2007, p. 287). Second, "every sustained activity … --including physical activities, sensory activities, learning, thinking, and imagining--changes the brain" (p. 288). Third, the "signature activities of a culture … require training and cultural experience and lead to the development of a new, specially wired brain" (pp. 290-291). Fourth, "'perceptual learning' … occurs whenever the brain learns how to perceive with more acuteness … or in a new way and in the process develops new brain maps and structure" (pp. 299-300). In short, our brains change to adapt in a variety of ways to the lives we lead (Begley 2007, pp. 8-9).

Brain scientists also find that being the recipient of prosocial behavior fosters positive brain change and that being the recipient of antisocial behavior contributes to

harmful brain change (Eisler and Levine 2002, p. 18). This is particularly true for children whose early experiences determine to a great degree their later patterns of behavior (pp. 18-19). Among these determinants of later behavior are a child's family, cultural, and societal experience. One interesting finding is that damage due to the experience of "uncaring behavior is reversible when there is sufficient social support" (p. 40). Relatedly, psychotherapy has been shown to produce detectable changes in the brain. "Recent brain scans done before and after psychotherapy show both that the brain plastically reorganizes itself in treatment and that the more successful the treatment the greater the change" (Doidge 2007, p. 233). This all indicates that "we are not prisoners of our genes" (Eisler and Levine 2002, p. 39) and that humans can overcome poor experience and learn better behavior, changing their brains in the process.[3] [4]

There are some other interesting findings that point in the direction of brain plasticity. For example, the cortical areas of meditators' brains have been found to be thicker than nonmeditators and are less subject to decline in thickness with age (Baime 2011, p. 47; see also Begley 2007, pp. 8, 212-242). There is also much evidence that the "human brain adjusts to environmental stress via gain or loss of cells and synapses" (Wilson 2006, p. 627). Another very significant consideration involves the distinction between personal temperament (largely inherited) and character (largely formed through experience) (Levine 2006, p. 622). Thus, character development is one aspect of brain plasticity, and it has three components: self-directedness, cooperativeness, and self-transcendence (p. 623). When all three character components are simultaneously at high levels, that has been found to be related to the healthiest mental functioning, and when all are at low levels, that is associated with the lowest levels of mental health. Two of the

character components (self-directedness and cooperativeness) are strongly and directly associated with successful economic behaviors (p. 623).

Findings of Brain Science: Empathy

As explained earlier, we humans have an empathetic nature by virtue of the old mammalian part of our brains. Thus, a number of scientists have remarked that the capacity for empathy is a fundamental part of being human (see, for example, Eisler and Levine 2002, p. 25 and Singer 2009, p. 254). As the Swedish psychologist Ulf "Dimberg demonstrated … we don't decide to be empathetic – we simply are" by virtue of our humanity (de Waal 2009, p. 66). The German psychologist Theodor Lipps called empathy an "instinct" in the sense that we have it from birth (p. 67). This is in contrast to the discredited view that empathy is a voluntary process requiring role-taking and higher cognition (p. 78). This latter view implies that "individuals faced with others in need decide whether to help, or not, by mentally tallying up costs and benefits" (p. 115). Even though empathy is apparently a natural, robust human trait that can be counted on, many societies make substantial efforts to foster and grow it. These efforts make sense in the light of the growing evidence of brain plasticity. It is also important to note that how an individual expresses empathy is determined by how one's empathetic quality has been developed and the degree to which it has been developed, both of which depend on the existence of brain plasticity (Begley 2007, p. 9).[5] And as Singer (2009, pp. 253, 265) points out, there is evidence that individual differences in empathy are a good predictor of whether or not a person is high or low in selfishness and whether or not he/she is engaged in prosocial behavior.

Eisler and Levine (2002, p. 12) emphasize that although empathetic behavior has a genetic basis, there is much evidence that experience influences development of the brain circuits involved in empathy (and many other behaviors). Moreover, they believe that experience interacts with inherited temperament and personality to determine behavior by altering brain chemistry and structure. For example, positive and caring experiences strengthen neural circuits associated with positive emotions and bonding, and this happens in the presence of dopamine and oxytocin (p. 13). Dopamine inputs are stimulated by generosity, creativity, and good moods; whereas oxytocin inputs are stimulated by positive emotions relating to social and family connections. The upshot is that our experience along with our long evolutionary inheritance jointly determine our very important capacity for empathy.

Historical Perspective on Empathy

Although empathy is part of the very nature of humans, it has manifested differently through the "great stages of human history—forager/hunter, hydraulic agriculture, and the First, Second, and emerging Third Industrial Revolutions" (Rifkin 2009, p. 612). Through these stages,

> "human consciousness expanded to encompass the complex energy/communications structures we created. Mythological consciousness, theological consciousness, ideological consciousness, psychological consciousness, and now dramaturgical consciousness mark the evolutionary passages of the human psyche. And with each successive reorientation of consciousness, empathic sensibility reached new heights" (pp. 612-613).

Whereas in forager-hunter societies, empathetic feelings rarely extended beyond those in one's tribe, "today empathy is beginning to stretch beyond national boundaries to biosphere boundaries" (Rifkin 2010, p. 2). According to Rifkin (2009, p. 452), this marks the "greatest surge in empathetic extension in all human history."

The Hard Brain and the Soft Brain

To progress beyond basic DMT and gain greater understanding of economic behavior, what is needed is clearer conceptual links among 1) brain science, 2) the DMT model, and 3) economic concepts related to intangible capital formation. To start, we need a clear distinction between the part of the brain that is our genetic inheritance and the other part that develops in response to experience or as a consequence of our intentional efforts. Recall that the former part of the brain, which is associated with brain physiology, has been labeled the hard brain. It is the part all humans have regardless of age, education, or experience. The other part of the brain is the soft or plastic brain. Depending on people's activity, the soft brain becomes larger or smaller and reorganizes or restructures itself; it cannot be expected to develop or function in the same way in every person. The soft part also develops differently depending on one's family, culture, socio-economy, experience, and so on. As MacLean has explained, the hard brain of humans has evolved over many millions of years and has a large role to play in governing our relatively automatic or instinctive behavior. The soft brain, on the other hand, is to a large degree associated with the gray matter of the neocortex and is to a much greater degree concerned with intentional decision making, planning, and problem solving in response to external situations. Some of the soft brain's development is a product of efforts by people to improve themselves, perhaps economically, and represents these

persons' investment in intangible capital (standard human capital, social capital, personal capital, and so on). As indicated earlier, it is the soft brain that determines how the capacity of the hard brain gets expressed. Different individuals and societies are very different in this regard.

The Revised DMT Model of the Human Brain

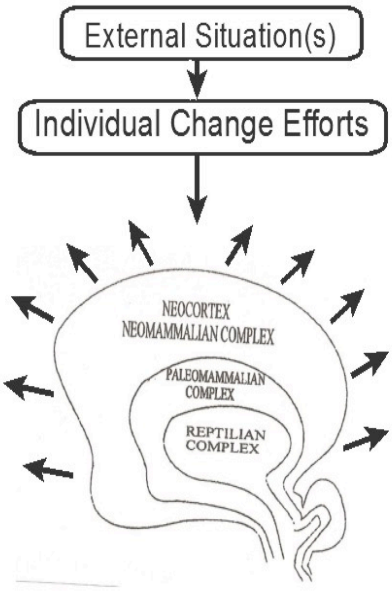
Based on the scientific findings regarding brain plasticity and the brain's capacity for empathy, it makes sense to revise the DMT brain model. The following revised model adds two features (5 and 6) not present in the original model:

1) People have two dominant motivations (ego and empathy)
2) People have limited cognitive capacity
3) People have a strong capacity to achieve a balance between the two dominant motivation
4) People tend to be rational in two senses: applying reason to attain goals and striking a balance between self- and other-interest.
5) People have many different soft brain mental capacities, and people are often highly motivated to raise some of these capacities (especially empathetic capacity) as part of their human development efforts
6) People and societies differ in their mental capacities based on the soft brain (or intangible capital) investments that they have made. Their mental capacities are typically below their potential level.

Figure 1 below shows a side view representation of MacLean's triune brain with the three familiar modules. What is added is that the individual is making change efforts in response to the encountered external situation.. As a result, the neocortex region of the

Figure 1

Growth of Neocortex in Response to Individual's Efforts to Deal with External Situation(s)



Source: Cory (2006)

brain experiences growth and restructuring as shown by the outward arrows emanating from the neocortex. That growth reflects investments in intangible capital that produce change in the soft brain, more specifically growth, largely in the neocortex.

Implications of the Revised Model

Does the revised model which incorporates the possibility that people may grow in their soft brain mental capacities make a difference? Yes! When people, intentionally or not, grow mentally, becoming more competent to handle life situations, their brain's neural pathways develop. Following Goleman (1995, 1998), they develop emotional intelligence involving a variety of emotional competences. People's efforts in this regard can be interpreted as an investment in personal capital (see, for example, Tomer 2003) or as investment in noncognitive human capital (see, for example, Heckman and Rubinstein 2001). A person's investments in personal capital may enable them to manage their emotions better, raise their empathy levels, and attain a more balanced lifestyle. The particular personal capital investments that an individual is likely to make will presumably reflect their family, cultural, and societal background. In many cases, people will be motivated to make personal capital investments in areas where they are relatively deficient. Based on societal recognition of common mental capacity deficits, societal leadership may try to influence the overall direction of people's investments in personal capital, thereby attempting to overcome the perceived societal weakness. In general, it seems fair to say that people's overall development of their mental capacities typically falls far short of their potential. Thus, although this intangible investment activity may enable people to achieve a higher level of empathy and a better balance between empathy and ego, for most people it is unlikely to achieve anything close to an ideal. This is so

despite the tendency toward balance, which is a prominent feature of the basic DMT model.

Arguably, when an individual invests in intangible capital such as personal capital, this might contribute to the quality of the individual's empathy, improve his ego/empathy balance, and thereby improve the socio-economy's economic performance. When many people have greater empathy and a better ego/empathy balance, there will be more reciprocal behavior (following Cory (2006)), enabling increased market economic activity. This is likely to lead not only to increased economic growth and development in poor, backward economies, but greater realization of the economic potential of advanced socio-economies. As Adam Smith seemed to recognize, "we achieve the true wealth of a nation only with … [a] symbiotic and integrated balance" of ego and empathy (Lynne 2002, p. 585; see also Sheeder and Lynne (2011 forthcoming, p. 10)). Moreover, as Rifkin (2009) has suggested, the coming of the Third Industrial Revolution, which is associated with advanced, distributed information and communications technology and a distributed, renewable energy regime, will make possible further growth in empathy. To take full advantage of this possible empathy growth will require further investment in personal capital.[6]

Sheeder and Lynne's (2011 forthcoming) research related to the conservation decision making of farmers in Nebraska and Kansas indicates that farmers' decisions are far from being purely self-interested. The evidence indicates that farmers by and large temper their pursuit of self-interest with consideration for the interests of others. Statistical tests of the decision making model are consistent with the hypothesis that farmers are motivated by both financial self-interest and empathetic concern for

downstream water users with respect to their choices regarding farm processes and conservation. Further, the data indicate that the farmers' other-interest motivation is actually greater than their self-interest motivation. According to Sheeder and Lynne, "farmers seek to balance and integrate, seeking pragmatic "peace-of-mind" in contrast to strictly utilitarian solutions, finding what works best at the time to resolve and satisfy their dual interests" (p. 34). In other words, it is not only that in their decision-making efforts farmers are attempting to balance ego and empathy but that there is much learning effort (or investment) going into their empathizing and creating the right balance of ego and empathy.

It is interesting to speculate on the role of and importance of the different kinds of investment in intangible capital with respect to economic performance. Surely, some socio-economies can benefit more from intangible investment than others. Some socio-economies no doubt manifest typical pathologies that are associated with a lack of ego/empathy balance and too little investment in empathy augmenting intangible capital. Presumably, there are characteristic tension/stress patterns in these socio-economies that are associated with either an overly egoistic or overly empathetic pattern. Probably these unbalanced, and thus, poor performing socio-economies suffer from different types of market or economic failure. It should be noted that although investment in appropriate types of intangible capital might be the best prescription to deal with a situation involving a deficient ego/empathy balance, there are no doubt other ways to handle the problem. A socio-economy might for instance resort to developing norms, values, institutions, and government regulation to lessen their economic pathology.

An Implication for Government Policy

One obvious general implication of the DMT model is that behavior reflecting a desirable balance of ego and empathy is good for both the economy and society. The implication for government policy is that government leaders who recognize a problematic ego/empathy imbalance occurring might want to try to exert a positive influence on the situation. There is a significant recent example that illustrates this. This is the situation that occurred in the aftermath of the shooting in Tucson, Arizona on January 8, 2011 that left six people dead and Representative Gabrielle Giffords severely injured from a gunshot wound. President Obama discerned that in the U.S. in the period prior to the shooting there had been an increasingly vitriolic public atmosphere. Accordingly, in a public talk, he asked, "What has gone so terribly wrong with America? Why are we becoming more aggressive, violent, self-interested and intolerant as a society?" (Rifkin 2011). He spoke of the rising plague of intolerance that is spreading across the land. Thus, President Obama called on Americans to "sharpen our instincts for empathy." This was a clear plea for a better national balance between ego and empathy.

While President Obama's response to the Tucson tragedy seemed appropriate, this action by itself is unlikely to be more than a short-run corrective. There is clear need for a sustained, long-run governmental response to the apparent lack of empathy. Thus, it is noteworthy that Obama's Tucson action is apparently part of a larger policy initiative. According to Rifkin (2009, p. 177), President Obama "has made empathy the core of his political philosophy and the centerpiece in his political decisions, from the conduct of foreign policy to the selection of Supreme Court Justices." Hopefully, this Obama administration policy initiative will lead to growth of the nation's empathic capacity.

The Failure of Mainstream Economics:

Toward a More Human Economics

The failure of mainstream economics stems first from not recognizing the fundamental importance of empathy and second from overemphasizing ego, i.e., it stems from self-interest motivation unbalanced by concern for others. This is not just an academic or theoretical problem. Mainstream economic conceptions affect society overall because these conceptions influence the design of institutions, the expression of values, and the development of norms, all of which, if relatively unbalanced, lead to excessive tensions and stress in the socio-economy and corresponding harmful consequences for the citizenry. If economics were to incorporate empathy as a fundamental motivation, it would mean putting less emphasis on incentives appealing to self-interest and putting more emphasis on developing institutions, norms, values, and ethics consistent with an appropriate balance of self- and other-interest. Further, it would mean that the man in economics is a full-brained man. And that would make it possible to conceive of creating not just a more efficient economy but a better society in which good human relations, win-win relations, predominate, i.e., a more humane society.

The Promise of the Revised DMT Model

In light of the revised DMT model, it is clear that simply relying on the innate human tendency for ego/empathy balance is unlikely to produce anywhere near optimal economic performance. To realize its economic potential, a socio-economy must make substantial investments in the types of intangible capital necessary to raise its empathetic capacity and its capacity for achieving ego/empathy balance.

Economics (or socio-economics) might be quite different if it were based on a more realistic conception of human brain capacities. Here's a list of questions that a more human economics might be able to find better answers to:

1) In what way is human development involving growth in brain capacity an essential part of economic growth and development?

2) To what extent does growth of well-being require not just growth in cognitive capacity and tangible capacity but growth in a variety of intangible human capacities?

3) In what ways have unbalanced human development associated with societal pathology retarded economic growth?

4) Is it possible to anticipate, and thereby encourage, the growth in brain capacity that will be necessary in the future to take advantage of new economic growth possibilities?

There is reason to believe that an economics that is based on an accurate knowledge of the human brain, and thus human development potentials, will be able to speak more authoritatively regarding issues of economic development and be better prepared to answer the kind of questions listed above.

Conclusion

Gerald Cory has done a great job in bringing economists' attention to MacLean's perspective on brain physiology and in developing its implications for economic motivation. The resulting DMT has made a very important contribution insofar as it explains why humans are not motivated solely by self-interest but by a shifting balance of ego and empathy. While recognizing this contribution, this paper has sought to go beyond the basic version of DMT and to recognize that human behavior is not simply

determined by the inherited triune brain structure. Further, this paper has sought to revise DMT by introducing brain plasticity, especially with regard to empathy. The resulting brain model is different in some important respects from the basic DMT brain model, dramatically different from the ME model, and has important implications for economics and policy.[7]

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[1] In some of the writings of Gerald Cory (e.g. 2006, p. 38) and Gary Lynne (e.g. 2002; 2006, p. 649), there is a tendency to idealize human behavior that is motivated by a favorable balance of ego and empathy.

[2] Although the ME model of the brain is quite different from the DMT model, there is a sense in which the ME model can be considered a special case of the DMT model. This is the case where 1) empathetic motivation is zero, 2) cognitive capacity is very high, 3)

rational behavior only involves striving for self, and 4) other brain capacities are low or nonexistent.

[3] Cory (2006, p. 27) himself has acknowledged the role of life experience.

[4] According to Eisler and Levine (2002, p. 26), while genes no doubt affect human behavior, the inhibition or expression of those genes may be a product of conditions that people experience.

[5] According to Rifkin (2009, p. 177), "While primitive empathic potential is wired into the brain chemistry of some mammals, and especially the primates, its mature expression in humans requires learning and practice and a conducive environment."

[6]Rifkin (2009, pp. 613-614) seems to recognize this. He states "The empathic predisposition that is built into our biology is not a fail-safe mechanism that allows us to perfect our humanity. Rather, it is an opportunity to increasingly bond the human race into a single extended family, but it needs to be continually exercised."

[7] There is reason to believe that the Adam Smith who wrote

> "How selfish soever man may be supposed, there are evidently some principles in his nature, which interest him in the fortune of others, and render their happiness necessary to him, though he derives nothing from it, except the pleasure of seeing it." (Smith 1966, p. 3)

in *The Theory of Moral Sentiments* would approve of the revised DMT model.